



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/709,288	04/27/2004	Irene Spitsberg	133323	3287

30952 7590 03/20/2007
HARTMAN AND HARTMAN, P.C.
552 EAST 700 NORTH
VAIPARAISO, IN 46383

EXAMINER

AUSTIN, AARON

ART UNIT	PAPER NUMBER
----------	--------------

1775

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/20/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/709,288	SPITSBERG ET AL.	
	Examiner	Art Unit	
	Aaron S. Austin	1775	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 February 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16, 41 and 43-48 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16, 41 and 43-48 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date: _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date: _____ | 6) <input type="checkbox"/> Other: _____ |

Art Unit: 1775

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-4, 10, 41, and 43-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,410,148 B1 to Eaton, Jr. et al.

Regarding claims 1-4, 41, 43 and 44, Eaton '148 discloses a silicon –containing substrate with a coating of stoichiometric barium strontium aluminosilicate (BSAS) having 25 mole% BaO+SrO₂, where SrO₂ can be 0.1-0.90mole or .25-.75 25 mole% Al₂O₃, and 50 mole% SiO₂ (column 1 lines 55-60, column 2 lines 3-10, column 3 lines 10-25) and no indication of a non-stoichiometric material. Eaton '148 discloses that the stoichiometric phase should be at least 50% by volume, which includes 100%, indicating that a higher the stoichiometric phase content would produce a better crystal

Art Unit: 1775

structure integrity and thus a better structural integrity of the barrier layer (column 3 lines 34-44). Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to maximize the stoichiometric phase or to eliminate any non-stoichiometric phase because "The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages." In re Hoeschele, 406 F.2d 1403, 160 USPQ 809(CCPA 1969).

Further, Eaton'148 discloses heat treating the product after formation (column 5 lines 9-17). Because the prior art exemplifies the applicant's claimed composition in relation to the substrate intermediate layer and coating as well as the heat treating process used to create the absence of porosity as disclosed by the applicant, the claimed physical property relating to the porosity after heating is inherently present in the prior art. Absent an objective evidentiary showing to the contrary, the addition of the claimed physical property to the claim language fails to provide patentable distinction over the prior art.

Regarding claim 10, Eaton'148 discloses the coating as including an intermediate layer of silica or mullite (column 3 lines 55-65).

Claims 1-4, 10, 41, and 43-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,254,935 B1 to Eaton et al.

Regarding claims 1, 2, 41, 43 and 44, Eaton '935 discloses a silicon substrate with an intermediate layer, and with a thermal barrier layer of barium-strontium aluminosilicate (BSAS) (abstract, column 2 line 64-column 3 line 7 and column 3 lines

Art Unit: 1775

43-51). Eaton '935 discloses the barium strontium aluminosilicate comprises from 0.10-0.9 mole BaO, 0.10-0.9 mole SrO, 1.0 mole Al_2O_3 and 2 mole SiO_2 creating a stoichiometric composition of BSAS. The barrier layer being stoichiometric, no non-stoichiometric phase with sub stoichiometric silica is indicated. Eaton '935 discloses that the stoichiometric phase should be at least 50% by volume, which includes 100%, indicating that a higher the stoichiometric phase content would produce a better crystal structure integrity and thus a better structural integrity of the barrier layer (column 3 lines 16-26). Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to maximize the stoichiometric phase or to eliminate any non-stoichiometric phase because "The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages." In re Hoeschele, 406 F.2d 1403, 160 USPQ 809(CCPA 1969).

Further, Eaton '935 discloses a silicon substrate with one or more intermediate barrier layers of SiO_2 or mullite, and with a thermal barrier layer of barium-strontium aluminosilicate (BSAS) (abstract, column 2 line 64-column 3 line 7 and column 3 lines 43-51). Eaton '935 discloses the intermediate Eaton '935 discloses the barium strontium aluminosilicate thermal barrier (upper) layer comprises from 0.10-0.9 mole BaO, 0.10-0.9 mole SrO, 1.0 mole Al_2O_3 and 2 mole SiO_2 creating a stoichiometric (at least 50% celsian) composition of BSAS (column 3 lines 20-24). This composition allows for a thermal barrier upper layer coating having a composition with 25% mole% BaO+SrO, 25% Al_2O_3 , 50% SiO_2 and a SrO content of less than 25 molar% of the

Art Unit: 1775

BaO+SrO content (column 2 line 64-column 3 line 7) The barrier layer being stoichiometric, no non-stoichiometric phase with sub stoichiometric silica or alumina phase is indicated. This is all in the as-deposited condition. Eaton'148 discloses heat treating the product after formation (column 5 lines 9-17). Because the prior art exemplifies the applicant's claimed composition in relation to the substrate intermediate layer and coating as well as the heat treating process used to create the absence of porosity as disclosed by the applicant, the claimed physical property relating to the porosity after heating is inherently present in the prior art. Absent an objective evidentiary showing to the contrary, the addition of the claimed physical property to the claim language fails to provide patentable distinction over the prior art.

Regarding claims 3-4, Eaton '935 discloses the composition indicated above for BSAS (from 0.10-0.9 mole BaO, 0.10-0.9 mole SrO, 1.0 mole Al_2O_3 and 2 mole SiO_2) allows for a thermal barrier upper layer coating having a composition with greater than or equal to 47 mole% silica with 25% mole% BaO+SrO, 25% Al_2O_3 , 50% SiO_2 and SrO content of less than 25 molar% of the BaO+SrO content and having incidental impurities.

Regarding claim 10, Eaton '935 discloses all of the limitations of claim 1 and discloses one or more intermediate layers between the substrate and the barium strontium aluminosilicate and discloses the layers may include SiO_2 or mullite layers (column 3 lines 38-45).

Art Unit: 1775

Claims 5-9 and 11-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,254,935 B1 to Eaton et al. as applied to claim 1 above in view of U.S. Patent 6,352,790 B1 to Eaton et al.

Regarding claims 5-6, 8 and 15, Eaton '935 discloses all of the limitations of claims 1 and 11 and the following composition for BSAS: (from 0.10-0.9 mole BaO, 0.10-0.9 mole SrO, 1.0 mole Al_2O_3 and 2 mole SiO_2). This composition allows for a thermal barrier upper layer coating having a composition with 25% mole% BaO+SrO, 25% Al_2O_3 , 50% SiO_2 (column 2 line 64-column 3 line 7). Eaton '935 discloses one or more BSAS-containing layers, as an intermediate layer or a second protective coating for the purpose of providing advanced adhesion between the barrier layer and the substrate (column 3 lines 40-49). Although Eaton '935 does not disclose an alumina content greater than 25% or an alumina phase up to about 2%, Eaton '790 discloses an alumina enhanced BSAS coating with an Al_2O_3 additive up to 30% by weight that is capable of forming a reaction product with free silica and therefore capable of improving adhesion of the barrier coating with the substrate (column 3 lines 5-6 and 9-11).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to use the alumina-enhanced BSAS-containing layer of Eaton'709 as the intermediate or second barrier layer of Eaton'935 to improve the adhesion of the surface barrier layer to the substrate. This alumina enhancement provides for an alumina content of the barrier coating of greater than 25%. Although Eaton'790 does not expressly disclose up to only 2% of the Al_2O_3 phase, it would have been obvious to a person having ordinary skill in the art at the time of the invention to adjust the Al_2O_3

Art Unit: 1775

phase within the disclosed range for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Furthermore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to have selected the overlapping portion of the ranges disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness, In re Malagari, 182 USPQ 549.

Regarding claim 7, Eaton'935 discloses all of the limitations of claims 1 and 6 and discloses the lower or second barrier region layer, of a BSAS-containing intermediate layer is provided to enhance adhesion between the BSAS barrier layer and the SiO₂ substrate (column 3 lines 40-43). Although Eaton'935 does not disclose a second region of less than 47 mole% SiO₂, Eaton'790 discloses a barrier layer comprising a BSAS coating with an Al₂O₃, BaO.6 Al₂O₃, BaO, Al₂O₃, SrO.6 Al₂O₃ or SrO.Al₂O₃ additive that is capable of forming a reaction product with and therefore adhering to SiO₂ (column 2 lines 6-20). Because the substrate is SiO₂, it would have been obvious to a person having ordinary skill in the art at the time of the invention to use the alumina enhanced coating of Eaton'790 as the lower barrier or an intermediate coating of Eaton'935 to enhance the adhesion between the substrate and the barrier layers. Eaton'790 discloses the additive may be present up to various weight percentages which would cause the SiO₂ to fall below 47 mol%, additionally, it would have been obvious to a person having ordinary skill in the art at the time of the invention to adjust the weight % additive for the intended application, since it has been held that

Art Unit: 1775

discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 9, Eaton '935 discloses a barrier layer or outer protective layer of greater than or equal to 0.5 mils or 12.7 microns overlapping the range or 10-25 microns (column 3 lines 30-34).

Regarding claims 11-14 and 16, Eaton '935 discloses a silicon substrate with one or more intermediate barrier layers of SiO₂ or mullite, and with a thermal barrier layer of barium-strontium aluminosilicate (BSAS) (abstract, column 2 line 64-column 3 line 7 and column 3 lines 43-51). Eaton '935 discloses the intermediate Eaton '935 discloses the barium strontium aluminosilicate thermal barrier (upper) layer comprises from 0.10-0.9 mole BaO, 0.10-0.9 mole SrO, 1.0 mole Al₂O₃ and 2 mole SiO₂ creating a stoichiometric (at least 50% celsian) composition of BSAS (column 3 lines 20-24). This composition allows for a thermal barrier upper layer coating having a composition with 25% mole% BaO+SrO, 25% Al₂O₃, 50% SiO₂ and a SrO content of less than 25 molar% of the BaO+SrO content (column 2 line 64-column 3 line 7) The barrier layer being stoichiometric, no non-stoichiometric phase with sub stoichiometric silica or alumina phase is indicated. This is all in the as-deposited condition. Eaton'148 discloses heat treating the product after formation (column 5 lines 9-17). Because the prior art exemplifies the applicant's claimed composition in relation to the substrate intermediate layer and coating as well as the heat treating process used to create the absence of porosity as disclosed by the applicant, the claimed physical property relating to the porosity after heating is inherently present in the prior art. Absent an objective

Art Unit: 1775

evidentiary showing to the contrary, the addition of the claimed physical property to the claim language fails to provide patentable distinction over the prior art.

Claims 45-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,410,148 B1 to Eaton, Jr. et al. as applied to claim 1 above in view of U.S. Patent 6, 299,988 B1 to Wang et al.

Eaton '148 discloses all of the limitations of claim 1 but does not disclose a stabilized zirconia layer on the protective coating. However, Wang discloses a silicon-containing substrate with an intermediate layer comprising BSAS and a stabilized zirconia thermal barrier coating. In addition to its thermal protective properties, Wang discloses the stabilized zirconia thermal barrier coating a capable of preventing the substrate materials from being in contact with the environmental oxygen (column 1 lines 37-41, column 2 lines 35-42 and column 3 lines 49-50 and 54-67). Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to apply a stabilized zirconia thermal barrier coating of Wang over the BSAS coating of Eaton '148 to add thermal insulation and additional oxidation protection to the substrate.

Claims 45-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,254,935 B1 to Eaton, Jr. et al. as applied to claim 1 above in view of U.S. Patent 6, 299,988 B1 to Wang et al.

Eaton '935 discloses all of the limitations of claim 1 but does not disclose a stabilized zirconia layer on the protective coating. However, Wang discloses a silicon-

Art Unit: 1775

containing substrate with an intermediate layer comprising BSAS and a stabilized zirconia thermal barrier coating. In addition to its thermal protective properties, Wang discloses the stabilized zirconia thermal barrier coating a capable of preventing the substrate materials from being in contact with the environmental oxygen (column 1 lines 37-41, column 2 lines 35-42 and column 3 lines 49-50 and 54-67). Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to apply a stabilized zirconia thermal barrier coating of Wang over the BSAS coating of Eaton '935 to add thermal insulation and additional oxidation protection to the substrate.

Claims 47-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,254,935 B1 to Eaton et al. in view of U.S. Patent 6,352,790 B1 to Eaton et al. as applied to claim 11 above in view of U.S. Patent 6, 299,988 B1 to Wang et al.

Eaton '935 in view of Eaton '790 discloses all of the limitations of claim 11 but does not disclose a stabilized zirconia layer on the protective coating. However, Wang discloses a silicon-containing substrate with an intermediate layer comprising BSAS and a stabilized zirconia thermal barrier coating. In addition to its thermal protective properties, Wang discloses the stabilized zirconia thermal barrier coating a capable of preventing the substrate materials from being in contact with the environmental oxygen (column 1 lines 37-41, column 2 lines 35-42 and column 3 lines 49-50 and 54-67).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to apply a stabilized zirconia thermal barrier coating of Wang over

Art Unit: 1775

the BSAS coating of Eaton '935 in view of Eaton '935 to add thermal insulation and additional oxidation protection to the substrate.

Response to Arguments

Applicant's arguments filed 2/6/07 have been fully considered but they are not persuasive.

In particular, applicant argues Eaton '148 and Eaton '935 do not teach sealed porosity formed by volatilization of the nonstoichiometric crystalline phase in a second heating step following the heating taught by Eaton '148 (see the present Remarks, page 12, lines 1-6). In support of this argument, applicant states that it is "only after subjecting the heat treated coating to temperatures over a range of about 1200 °C to 1600 °C does volatilization of the nonstoichiometric crystalline phase occur" (see the present Remarks, page 13, lines 16-18). However, as noted by applicant, Eaton '148 performs heat treatment above 1250 C and Eaton '935 performs heat treatment at a temperature greater than or equal to 1250 C. Both of the taught heat ranges overlap the range provided by applicant at which volatilization occurs. As the sealed porosity is a result of volatilization (see the present Remarks lines 12-13), the structural limitations of the claims are expected to be met over the heat ranges taught by the references.

With respect to the claimed application of heat in a second step as opposed to a single step, this limitation is indicative of product by process language. Heat applied in the taught range in a single step versus two independent steps is expected to cause comparable changes in structure as the heat ranges overlap. The above arguments

Art Unit: 1775

establish a rationale tending to show the claimed product is the same as what is taught by the prior art. “[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” *In re Thorpe*, 227 USPQ 964,966. Once the Examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product. *In re Marosi*, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983), MPEP 2113.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the

Art Unit: 1775

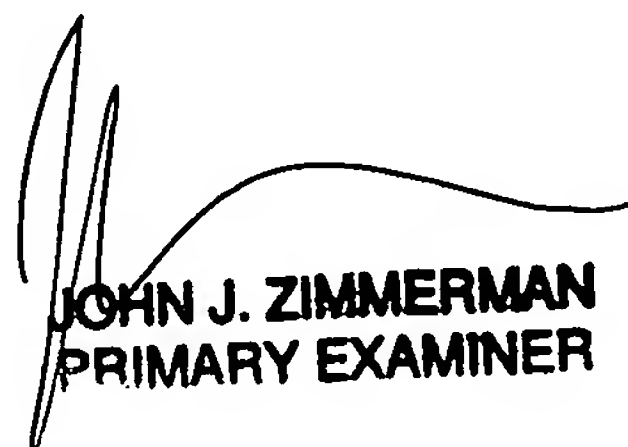
shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aaron S. Austin whose telephone number is (571) 272-8935. The examiner can normally be reached on Monday-Friday: 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on (571) 272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ASA



JOHN J. ZIMMERMAN
PRIMARY EXAMINER